

## Claims

What is claimed is:

[c1] A flip-chip package assembly comprising:

- a package substrate having a mounting surface;
- a semiconductor die mounted on a first portion of the mounting surface;
- a heat removal device physically secured to a second portion of the mounting surface; and
- a thermal interface material disposed between the semiconductor die and the heat removal device.

[c2] The flip-chip package assembly according to claim 1, wherein the heat removal device is a heat sink.

[c3] The flip-chip package assembly according to claim 1, wherein the heat removal device is physically secured to the second portion of the mounting surface by an adhesive.

[c4] The flip-chip package assembly according to claim 3, wherein the adhesive is disposed at a plurality of discrete locations on the second portion of the mounting surface.

[c5] The flip-chip package assembly according to claim 3, wherein the adhesive comprises eutectic solder paste.

[c6] The flip-chip package assembly according to claim 1, wherein the thermal interface material is selected from the group consisting of low melt solder phase change material, thermal tape and thermal grease.

[c7] The flip-chip package assembly according to claim 1, wherein a bottom surface of the heat removal device comprises at least one recess for accommodating the semiconductor die.

[c8] The flip-chip package assembly according to claim 7, wherein the bottom

surface of the heat removal device further comprises at least one recess for accommodating at least one electrical component mounted on the second portion of the mounting surface

**[c9]** A method for manufacturing a flip-chip package assembly comprising a package substrate and a semiconductor die, the method comprising:

disposing the semiconductor die on a first portion of a mounting surface of the package substrate;

physically securing a heat removal device to a second portion of the mounting surface; and

disposing a thermal interface material between the heat removal device and the semiconductor die.

**[c10]** The method according to claim 9, wherein the heat removal device is a heat sink.

**[c11]** The method according to claim 9, wherein physically securing the heat removal device comprises disposing an adhesive between the heat removal device and the second portion of the mounting surface.

**[c12]** The method according to claim 11, wherein the adhesive is disposed at discrete locations between the heat removal device and the second portion of the mounting surface.

**[c13]** The method according to claim 12, wherein the adhesive is eutectic solder paste.

**[c14]** The method according to claim 9, wherein the thermal interface material is selected from the group consisting of low melt solder phase change material, thermal tape and thermal grease.

**[c15]** The method according to claim 9, wherein a bottom surface of the heat removal device comprises at least one recess for accommodating the semiconductor die.

**[c16]** The method according to claim 15, wherein the bottom surface of the heat removal device further comprises at least one recess for accommodating at least an electrical component mounted on the second portion of the mounting surface.

[c17] A flip-chip package assembly, comprising:

- supporting means for providing support to a semiconductor die;
- heat removal means for dissipating heat from the semiconductor die;
- interfacing means for transferring heat from the semiconductor die to the heat removal means; and
- attaching means for attaching the heat removal means to the supporting means.